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Session 6 - Environmental Systems: Management and Optimisation

Session 7 - New Methods and Technologies for Medicine and Biology

Session 8 - Embedded System Design and Application

Session 9 - Image Processing, Image Analysis and Computer Vision

Session 10 - Mobile Communications

Session 11 - Education in Computer Science and Automation

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Preface

Dear Participants,

Confronted with the ever-increasing complexity of technical processes and the growing demands on their efficiency, security and flexibility, the scientific world needs to establish new methods of engineering design and new methods of systems operation. The factors likely to affect the design of the smart systems of the future will doubtless include the following:

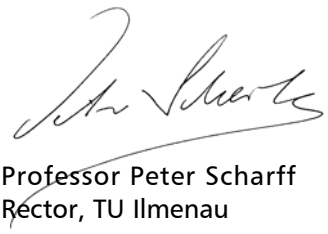
- As computational costs decrease, it will be possible to apply more complex algorithms, even in real time. These algorithms will take into account system nonlinearities or provide online optimisation of the system's performance.
- New fields of application will be addressed. Interest is now being expressed, beyond that in "classical" technical systems and processes, in environmental systems or medical and bioengineering applications.
- The boundaries between software and hardware design are being eroded. New design methods will include co-design of software and hardware and even of sensor and actuator components.
- Automation will not only replace human operators but will assist, support and supervise humans so that their work is safe and even more effective.
- Networked systems or swarms will be crucial, requiring improvement of the communication within them and study of how their behaviour can be made globally consistent.
- The issues of security and safety, not only during the operation of systems but also in the course of their design, will continue to increase in importance.

The title "Computer Science meets Automation", borne by the 52nd International Scientific Colloquium (IWK) at the Technische Universität Ilmenau, Germany, expresses the desire of scientists and engineers to rise to these challenges, cooperating closely on innovative methods in the two disciplines of computer science and automation.

The IWK has a long tradition going back as far as 1953. In the years before 1989, a major function of the colloquium was to bring together scientists from both sides of the Iron Curtain. Naturally, bonds were also deepened between the countries from the East. Today, the objective of the colloquium is still to bring researchers together. They come from the eastern and western member states of the European Union, and, indeed, from all over the world. All who wish to share their ideas on the points where "Computer Science meets Automation" are addressed by this colloquium at the Technische Universität Ilmenau.

All the University's Faculties have joined forces to ensure that nothing is left out. Control engineering, information science, cybernetics, communication technology and systems engineering – for all of these and their applications (ranging from biological systems to heavy engineering), the issues are being covered.

Together with all the organizers I should like to thank you for your contributions to the conference, ensuring, as they do, a most interesting colloquium programme of an interdisciplinary nature.
I am looking forward to an inspiring colloquium. It promises to be a fine platform for you to present your research, to address new concepts and to meet colleagues in Ilmenau.



Professor Peter Scharff
Rector, TU Ilmenau

Professor Christoph Ament
Head of Organisation

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CAMP: A New Tool to Analyse Mobility Management Protocols

ABSTRACT

All-IP networks will be as known the future B3G networks. Many Challenges have to be solved in order to make these networks as good as 2 or 3G networks. One of the main challenges is the developing of suitable mobility solutions to support seamless and fast movements in the network. A lot of mobility management protocols have been developed. These protocols should be analyzed and evaluated before the real implementation takes place. The analysis is performed by means of mathematical models, simulations or implementation in test labs. Mathematical analysis can be performed fast and delivers a good approximation of the performance. Simulation and implementation of protocols deliver detailed results. This takes however a long time. Therefore, it is important to build tools to simplify the analysis of mobility management protocols.

In this paper we introduce a new tool for Comparative Analysis of Mobility Management Protocols “CAMP”. This tool provides a set of functions that can be used to analyze the performance and the total cost of mobility protocols. The structure of the tools enables simple integrating of new protocols, which results in fast evaluate of the protocols.

I- CAMP OVERVIEW

CAMP, developed by the group of Integrated Hardware and Software systems (IHS) in the technical university of Ilmenau, is a flexible tool for analysis of mobility protocols and the protocols, which support Quality of Service (QoS) simultaneous with mobility. CAMP has of a flexible Graphical User Interface (GUI), shown in figure 1. This GUI is created dynamically based on configuration data stored in a database. The Tool analyzes the performance and the costs resulting from the protocols mentioned above. CAMP is

designed in such a way, that new protocols and algorithms can be integrated simply. This ensures the extendibility of CAMP.

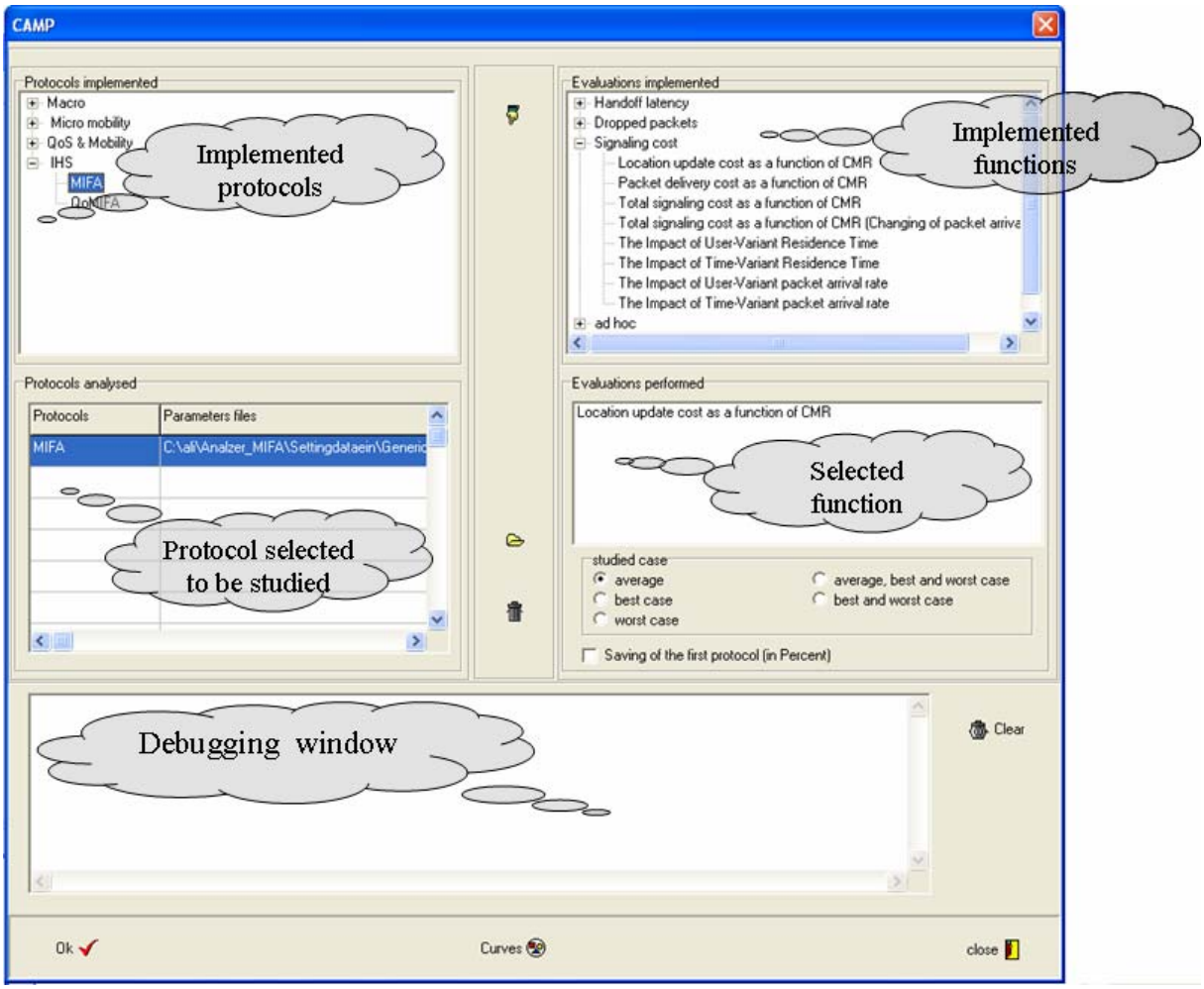

Figure 1: GUI of CAMP

I- TOOL STRUCTURE

Additional to the GUI, CAMP consists mainly of libraries package and a configuration database, the structure of CAMP is plotted in figure 2. All configuration parameters of CAMP are recorded in the configuration database, e.g. *GUI parameters, the support protocols, the implemented functions*…etc. This makes CAMP flexible and re-configurable. The libraries package contains the libraries required for the analysis. “G-libraries” presents the libraries specified for all implemented protocols, e.g. mobility models, queuing…etc. The “P-libraries” are protocol-specific libraries.

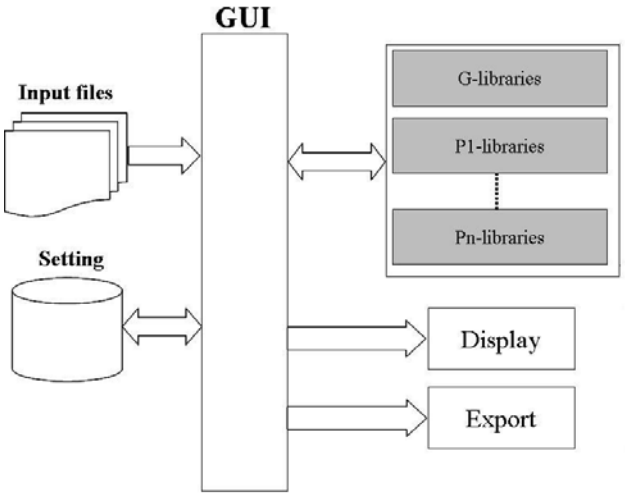

Figure 2: Structure of CAMP

“Input files” contains the parameters of the studied protocols. These parameters are written simply in scripts, an example of a parameter file is presented in figure 3. Our tool defines a simple semantic of the “Input files”. The parameter name should be preceded by “#”, where the value of the parameter value should be written in a new line direct under the parameter name. The comments can be expressed in many ways, see figure 3.

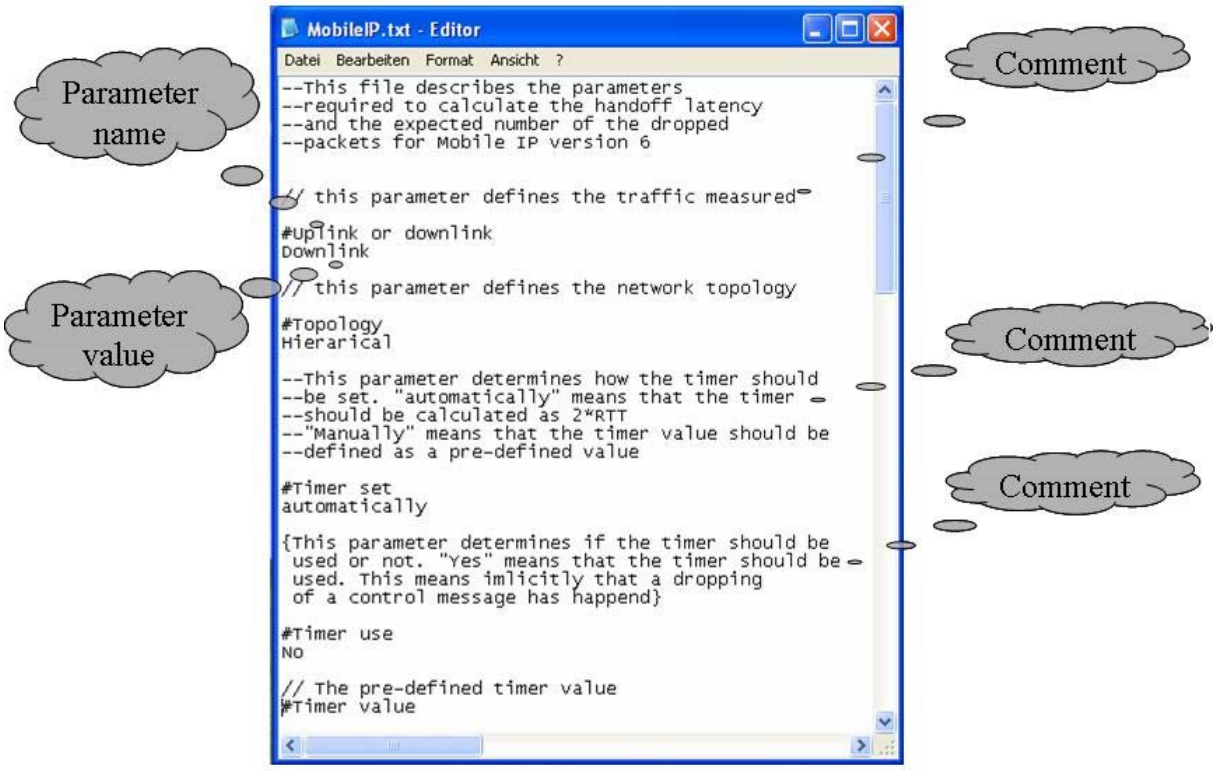

Figure 3: Example of a parameter file

The user should firstly define the protocols, which he wants to analyze. After that, each protocol should be linked to a parameters file. The user should select then the function

he wants to perform. CAMP reads the parameters, selects the adequate libraries and performs the desired analysis. The results are saved in a stream file. These results can be then shown in CAMP itself, as shown in figure 4, or can be exported to Microsoft Excel, where the user can analyze the results himself.

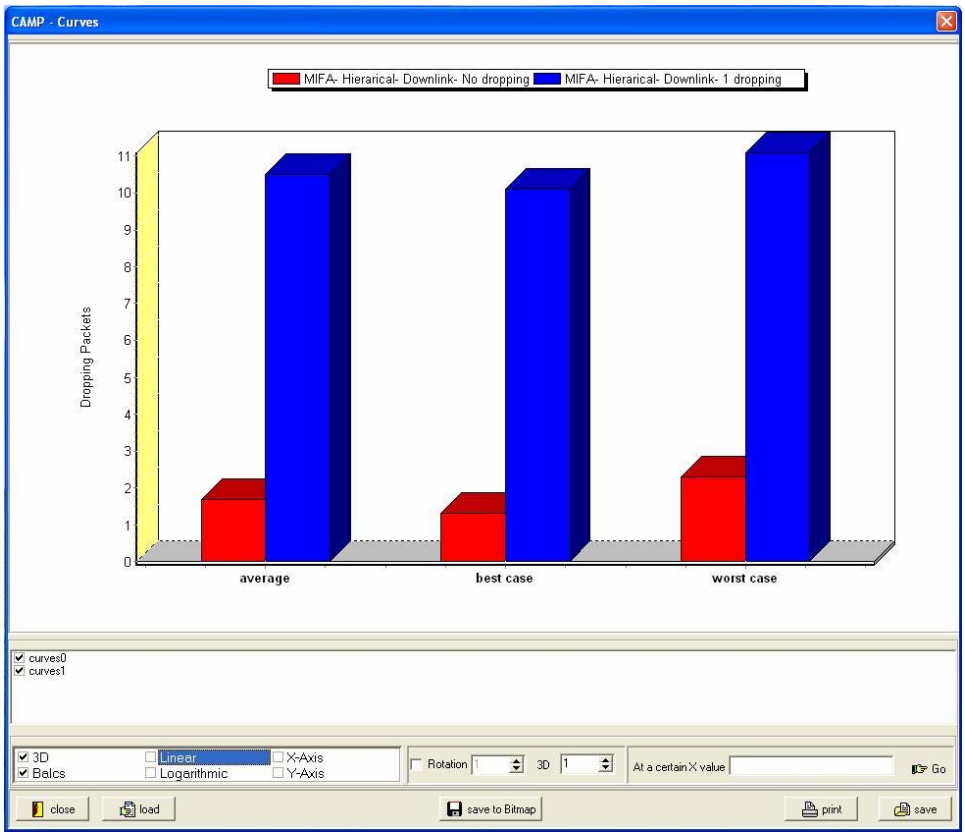

Figure 4: Display unit of CAMP

II- APPLICATION OF CAMP

CAMP implements a set of the known mobility management protocols such as Mobile IP (MIP) [1], Regional Mobile IP (RMIP) [2], Hierarchical Mobile IP (HMIP) [3], Cellular IP (CIP) [4], Handoff-Aware Wireless Access Internet Infrastructure (HAWAII) [5], Mobile IP Fast authentication protocol (MIFA) [6], low latency MIFA [7], Fast MIP [8], Proxy MIP [9]…etc. A set of the protocols supporting QoS simultaneously with mobility, e.g. Mobile RSVP [10], Hierarchical Mobile RSVP [11], QoS aware MIFA [12], is implemented too. The analysis comprises the performance and the total costs deploying different network topologies und different mobility models.

a) Performance analysis

Performance analysis comprises the estimation of the handoff latency, the expected number of dropped packets, the time required to reserve resources on a certain path

and the expected number of the packets sent as best effort while the reservation is in progress. CAMP analyses the performance taking into account the dropping of control messages, different network topologies and different mobility patterns. Figure 5 presents a sample for hierarchical network topology and the expected number of the dropped packets for MIFA, MIP, HMIPv6, AFA and HAWAII.

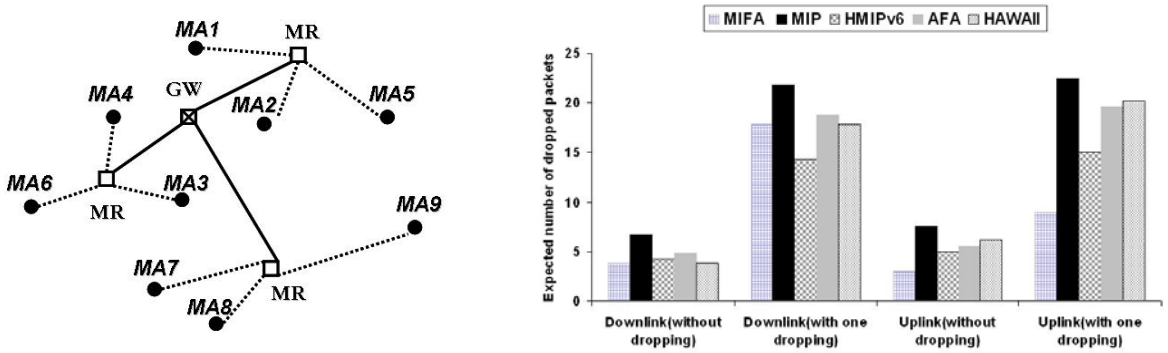

Figure 5: Expected number of dropped packets for MIFA, MIP, HMIPv6, AFA, HAWAII

b) Total cost

The total cost, produced from a certain protocol, comprises the location update cost and the packets forwarding overhead. Calculating of this cost depends on the model developed in [13]. In addition, the total cost can be studied under user- or time-variant parameters. Figure 6 presents a sample of network topology and the location update cost resulting from CAMP for MIFA, RMIP and HAWAII.

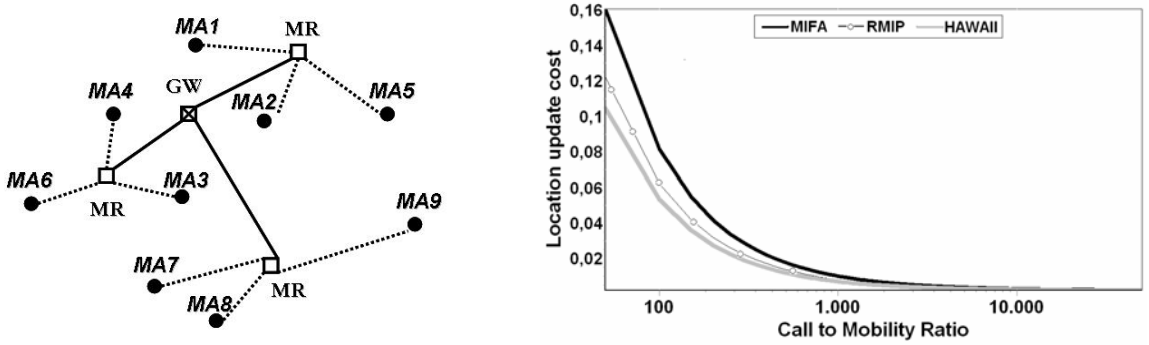

Figure 6: Location update cost for MIFA, RMIP and HAWAII

IV- CONCLUSION

In this paper we have presented a new tool to analyze the mobility management protocols and the protocols supporting QoS simultaneously with mobility. The analysis comprises the studying of the performance and the costs resulted from a certain protocol. The performance can be studied under various network topologies and under different mobility patterns. The dropping of control messages can be taken into account too.

CAMP is a powerful tool, which implements a large set of protocols and enables a fast estimation of the performance of a certain protocol compared to many others. New protocols and new algorithms can be integrated simply.

Currently, we are implementing other protocols and trying to write the parameters files automatically. In addition, we are working on interconnecting between TRIAS [14] and CAMP to enable more users with specified rights to work remote on this tool.

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Authors:

Dipl.-Ing Ali Diab
Prof. Dr.-Ing. habil. Andreas Mitschele-Thiel
TU - Ilmenau, Faculty for Informatics und Automation, Gustav-Kirchhoff-Str. 1, P.O.B. 10 0565
98693, Ilmenau
Phone: +49 3677 69 2819
Fax: +49 3677 69 1220
E-mail: {ali.diab|mitsch}@tu-ilmenau.de